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DEFENSE SYSTEMS MANAGEMENT COLLEGE



PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

PROGRAM MANAGEMENT WITHIN
A FUNCTIONAL ORGANIZATION
STUDY PROJECT REPORT
RPO 75-2

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PROGRAM MANAGEMENT WITHIN A
FUNCTIONAL ORGANIZATION

Study Project Report
Individual Study Program

by

John Allan Reif
GS-13 DNC

Study Project Advisor
Mr. William Cullin

November 1976

Defense Systems Management College

Program Management Course

Class 76-2

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE:

PROGRAM MANAGEMENT WITHIN A FUNCTIONAL ORGANIZATION

STUDY PROJECT GOALS:

1. To develop the concept of intensive management procedures in a functional organization.
2. Identify the issues, critical policy and procedures for implementing program management in an engineering organization.

STUDY REPORT ABSTRACT:

→ This study addresses the organization, policy and procedures for intensive management in the Naval Air Systems Command. Program management is the application of intensive management systems within the Material Acquisition Group. It is differentiated from Project Management due to its applications within an engineering service organization.

→ The study focus on the nature of the commodities selected for program management, the environment, management policy and implementation, and trade-offs in technical management and management of technical activities.

→ The results indicate that program management is a hybrid management system which will effectively operate within the organizational constraints (limited funds and manpower applied to uniquely defined work). Implicit in the evaluation is the successful decentralization of fleet support type engineering functions. Areas of future growth, cost estimating, and training category criteria are identified.

KEY WORDS: Program Management/Decentralization

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EXECUTIVE SUMMARY

The Naval Air Systems Command has established two methods to deal with the situations of declining manpower and limited funds in the Material Acquisition Group. Management by Objectives and Program Management are the methods utilized. Program Management has been applied to the Armament, Avionics and Propulsion commodity areas.

The study addresses the issues to implement intensive management procedures within the functional organization. The areas of study are the nature of the commodities involved, the organizations operating relationships and decentralization of functions necessary to implement program management and its scope. The approach is to compare and contrast the three commodity areas for analysis and recommendation for further consideration.

Evaluation of the intensive management procedure as utilized by the commodity areas have the following attributes:

- (a) Specific definable tasks of finite duration have been selected.
- (b) Deliberate conflict is structured in the organization to maximize personnel and scarce resources.
- (c) The commodity areas have the control of when, what and how the management of a technical activity takes place.
- (d) Line authority is clearly delineated.
- (e) Staffing a full time organization for an intensive management team is extremely limited. Part time assignments are the present method of implementation.
- (f) Information flows, appraisals and direction are heavily emphasized.

The areas for development center in training, communication and cost estimating responsibilities. With this emphasis, Program Management will prove responsive to NAVAIR goals.

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INTRODUCTION AND PURPOSE

With a peace time environment, the Congress will review and scrutinize more thoroughly the Department of Defense budget and manpower requirements. In terms of real purchasing power the Defense budget is on a positive upward slope. However, Congressional assessments of defense spending and pressures to allocate these limited resources elsewhere will constrain capitol resources - manpower, dollars, and force mixes for the foreseeable future (1:6).

In the Navy, the Naval Air Systems Command (NAVAIR) is finding difficulty in maintaining an effective commodity command which provides a centralized management system. Continued cuts in manpower and budgets have forced reorganization and decentralization. This is especially true in the Logistics and Material Acquisition Groups (AIR-04 and AIR-05 respectively).

Faced with this situation, the commodity areas are establishing their goals through two methods: Management By Objectives (MBO) and Program Management. Management By Objectives (MBO) was instituted as a formalized planning system in 1974 by the Material Acquisition Group. It is slowly maturing in that the development of the objectives is being accomplished at the strategic and coordinative levels of management. Implementation at the operating levels are slowly being accomplished.

Program Management within the Command is a relatively new idea in the sense of its application within a functional or service organization (Material Acquisition Group is basically an engineering organization.). Project Management has existed within the Command since its formal inception in July, 1966. Implementation of intensive management procedures within the functional organization is now due to two aspects; first it is formalized and recognized throughout the Command and Navy structure. Secondly, it is being done to highlight demands for scarce resources over extended periods of time. This in turn puts needs in priority within the general areas in which they operate, in this case Armament, Avionics and Propulsion commodity areas. These needs determine what functions will be decentralized to the field to meet the manpower and fiscal constraints which are decreasing over time (2,3).

This paper will focus on the set of issues which must be addressed to successfully implement intensive management procedures within a functional organization. These issues can be defined in the following categories:

- (a) Nature of the Commodity.
- (b) Operating relationships.
- (c) Decentralization of functions.
- (d) Scope of intensive management procedures (IMP).

The approach utilized in this paper will be to intensively study the Armament Division implementation of IMP and compare and contrast this with the Avionics and Propulsion Commodity implementation.

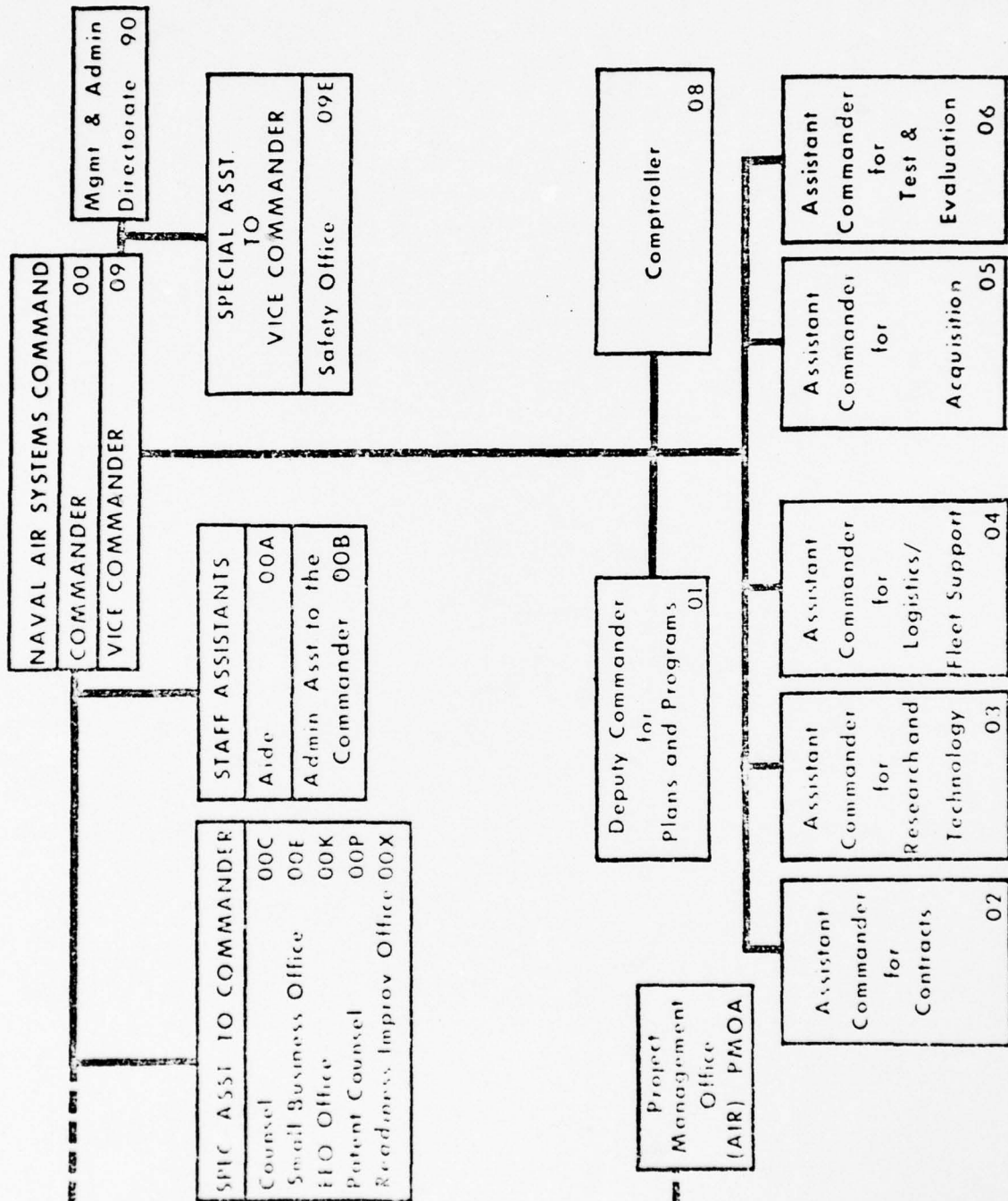
BACKGROUND AND ORGANIZATIONAL EVOLUTION

The Naval Air Systems Command is one of the five subordinate commands of the Naval Material Command established as part of the Navy Department Reorganization of 1966. The Naval Air Systems Command consists of Naval Air Systems Command Headquarters, NAVAIRHQ, and assigned shore (field) activities. NAVAIR is assigned material support responsibilities for (5:00):

- (a) Navy and Marine Corps aircraft systems including components.
- (b) Air launched weapon systems and components.
- (c) Airborne systems and commodities. (These include electronics, underwater sound systems, airborne pyrotechnics, mine countermeasures, targets and drones, photographic and meteorological equipment, ranges and instrumentation, training and ground support equipment.
- (d) Catapults, arresting gear, visual landing aids and jet blast deflectors.

NAVAIR is assigned the responsibilities for total system integration with respect to aircraft and weapon systems within the Naval Material Command for the life-cycle of these systems and components. The Command is organized into seven basic groups as shown in Figure 00-1. These groups perform a service function in the areas shown: Contracts (AIR-02), Research and Technology (AIR-03), Logistics/Fleet Support (AIR-04), Acquisition (AIR-05), Test and Evaluation (AIR-06), Comptroller (AIR-08). Project Management (PMA) and Project Coordinator (APC) functions reside in AIR-01 for administrative support. At the moment twenty-two PMA's and three APC's draw their support from AIR-01. The average size of these

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offices range from four to twelve individuals with the exception of the extremely complex systems, i.e. F-14, or the joint service/multinational projects (A-7 Aircraft or Sparrow Missile Systems).

Management as connoted in this organizational structure is a general term to specify central executive direction and control of the work effort by a chartered individual/organization. Co-ordination is a general term to denote direction and control of work efforts, and the processing of actions by the chartered individual/organization. The scope of work and designation of appropriate resources are assigned by charter in both cases.

Project Management is a term restricted to those major undertakings with a finite duration. This involves systems definition, development, production and logistics support of a weapon, equipment or support systems. Projects are specifically designated by the Secretary of the Navy, the Chief of Naval Material, or a Systems Commander. Project Managers are assigned the aforementioned authority to short-cut normal chain of command lines. Designated projects are given priority over other projects or programs (4:1).

Project Co-ordination is the term established for those projects not designated by the Secretary of the Navy or Chief of Naval Material. This concept allows the assignment of intensive management procedures with normal direction/co-ordination authority on a command-wide basis under the Deputy Commander or an Assistant Commander. Normally such projects fall within a specific segment of a weapon systems life-cycle. Due to the magnitude of the resources, priority or complexity, intensive management is deemed necessary in the following

categories:

- (a) Aircraft, missile and certain selected weapon/support projects in engineering development and production phases.
- (b) Research, exploratory and advance development phases of projects.
- (c) Component/support systems in engineering development, operational systems development and production phases.
- (d) Weapon/component/support systems projects in the out-of-production phase of the life-cycle.

The term Program Manager as defined within NAVAIR HQ has a somewhat different definition and application. Program Management involves items of less than major systems/subsystems/components/equipments in development, production, modification and initial logistical support. Usually they are definable as a separate block of level two of the work breakdown structure (WBS). Designation of a Program Manager is usually an additional assignment in their normal duties as a division director within the applicable command group. Generally the systems designated have applications in more than one major system or comprise a large commitment of resources by the major weapon system in its line item in the budget.

The authority and responsibilities of Program Managers are similar to the Project Managers/Co-ordinators. A minimum of management layering has been imposed by the Command. While the Program Manager is division director, he has a direct reporting channel to the Commander, Naval Air Systems Command on an exceptional reporting basis. The centralized direction/guidance responsibilities include planning, programming, budgeting, and execution and appraisal of

program efforts. The same degree of accountability exists as with any intensive management system.

Funding of a program can be accomplished a number of ways. The program manager may be allocated funds directly assigned in the budget under a specific Program Element Number. Alternately he has funds directed by other Project Managers/Co-ordinators as part of the allocated resources within the level two of the WBS in the major system budgeted line item. Further funds control could be assigned direction of work authority to the Program Manager after the funds have been allocated and obligated.

The sheer number of Project Managers/Co-ordinators of major aircraft and missile systems coupled with the multiple interfaces of field activities, co-ordination up/down the vertical chain of command and fleet interfaces resulted in a designation of a Class Desk Officer. Located in the Acquisition Group, Aircraft and Missile Systems Division, this single focal point provides the fleet/engineering aspect of every piece of equipment/component/subsystem/system and software associated with the aircraft missile system. Information, direction and funds flow through the class desk officer to the commodity divisions. As the class Desk Officer acts as the focal point for engineering of a major system, the evolution of the function results in a dual assignment as the lead assistant/assistant Project Manager. This function in AIR-05 is to co-ordinate the functional organizations for the purpose of technical integration, including the physical and performance compatibility of equipments/components/

subsystems/systems in single and multiple application weapons systems. These constraints are in turn applied to the Program Manager operating in the Acquisition Group.

The Acquisition Group is organized into the following commodity Divisions reporting to the Assistant Commander for Acquisition:

- (a) Material Acquisition and Reduction (AIR-05A)
- (b) Systems Analysis (AIR-503)
- (c) Evaluation Division (AIR-506)
- (d) Aircraft and Weapons Systems Division (AIR-510)
- (e) Engineering Division (AIR-530)
- (f) Crew Systems Division (AIR-531)
- (g) Armament Division (AIR-532)
- (h) Avionics Division (AIR-533)
- (i) Ground Support Equipment Division (AIR-534)
- (j) Evaluations Systems Division (AIR-535)
- (k) Propulsion Division (AIR-536)
- (l) Ship Installation Division (AIR-537)

Of these divisions, three are identified as Program Managers - Armament, Avionics and Propulsion (6:05).

ARMAMENT DIVISION (AIR-532)

The Armament Division has the responsibility within the Naval Air Systems Command for the management of weapons, components, stores and ancillary equipment intended to be carried by or released from the aircraft. Command wide management of these items are for assigned exploratory and advance developments, engineering development, production and basic design support engineering. These areas include weapons - Bombs, Rockets, Cluster Weapons, Chemical/Biological Weapons, Nuclear and Adaption Kits, Training and Practice Weapons; Gun systems and ammunition; Guided Missile warheads and fuzes; Cartridges and Cartridge Actuated Devices; Pyrotechnics and Chemiluminescent Devices; Launching and Suspension Equipment; Armament Monitor and Control Systems including equipments and components which control, release, firing and functioning of all the above items in the aircraft system.

In addition, the division is responsible for the total system software necessary to support these weapons and equipments - Delivery and safe escape data, vulnerability of weapons and aircraft systems as well as target/weapon selection and effectiveness, safety, compatibility and separation of weapons from the aircraft. The division is responsible for the management and coordination/harmonization functions associated with the acquisition and support of these systems/subsystems/equipments and components (7:1).

The division is organized as shown in Figure 532-1. The major interfaces and information flows are shown in Figures 532-2, 3, 4, and 5. As can be seen, the structure for Armament is widely diversified. Within the Command, exploratory and advance developments are the primary responsibility of AIR-350 (Ordnance Research and Technology Administrator). The logistical support resides with AIR-410 (Weapon Systems Logistics) while the acquisition management and systems engineering reside with AIR-532 for the entire weapon life cycle.

The organization is fractured by design with the sole systems responsibility residing in AIR-532. The elements are separated to allow maximum flexibility to the operating heads. The logistics group is function oriented while AIR-03 and AIR-05 are product oriented. In all areas span of control is large and decision making is forced to the lowest levels of the organizational structure (8:8).

With the adaption and designation of Program Management, the division has been forced to decentralize its life cycle engineering responsibilities. These actions are a cumulation of previous years' efforts by the environment in which the division operates. The emphasis of conventional strike warfare was assigned largely to the Air Force. This has led to a decreasing priority of the Armament's area within NAVAIR. This, coupled with increased emphasis on consolidation of duplicative areas, better long range planning and coordination, reduced personnel and a peace time environment has forced increasing technical management workloads at the expense of systems engineering. Internal emphasis has been applied through

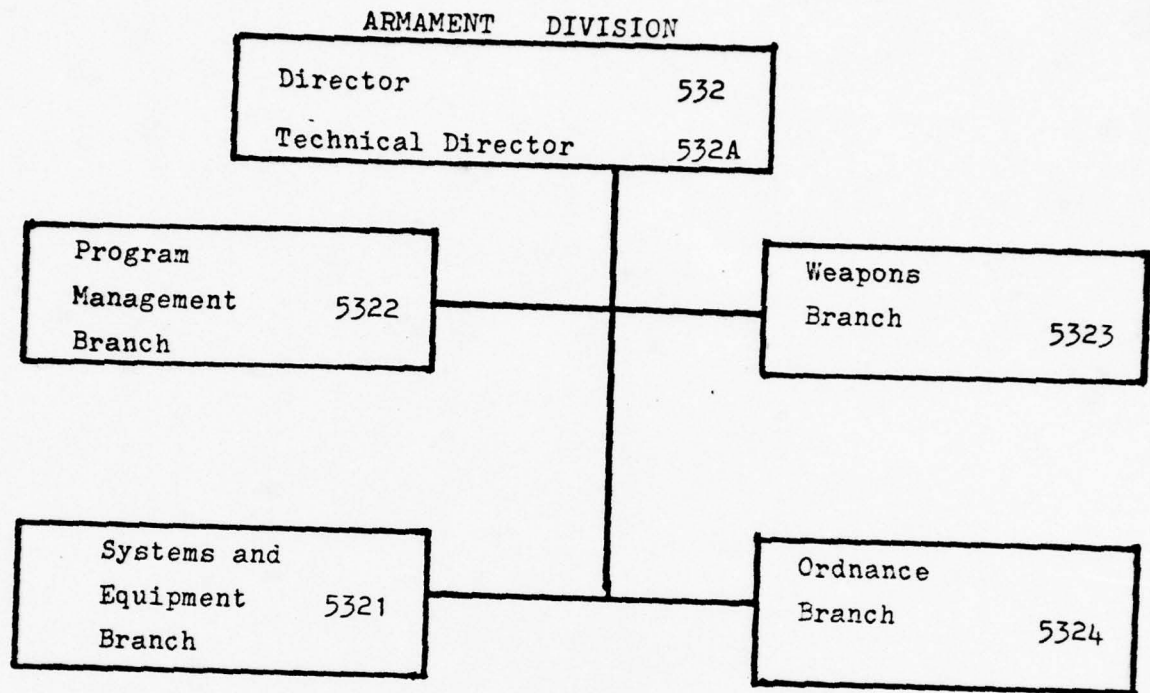


FIGURE 532-1

SYSTEMS AND EQUIPMENT BRANCH
AIR-5321

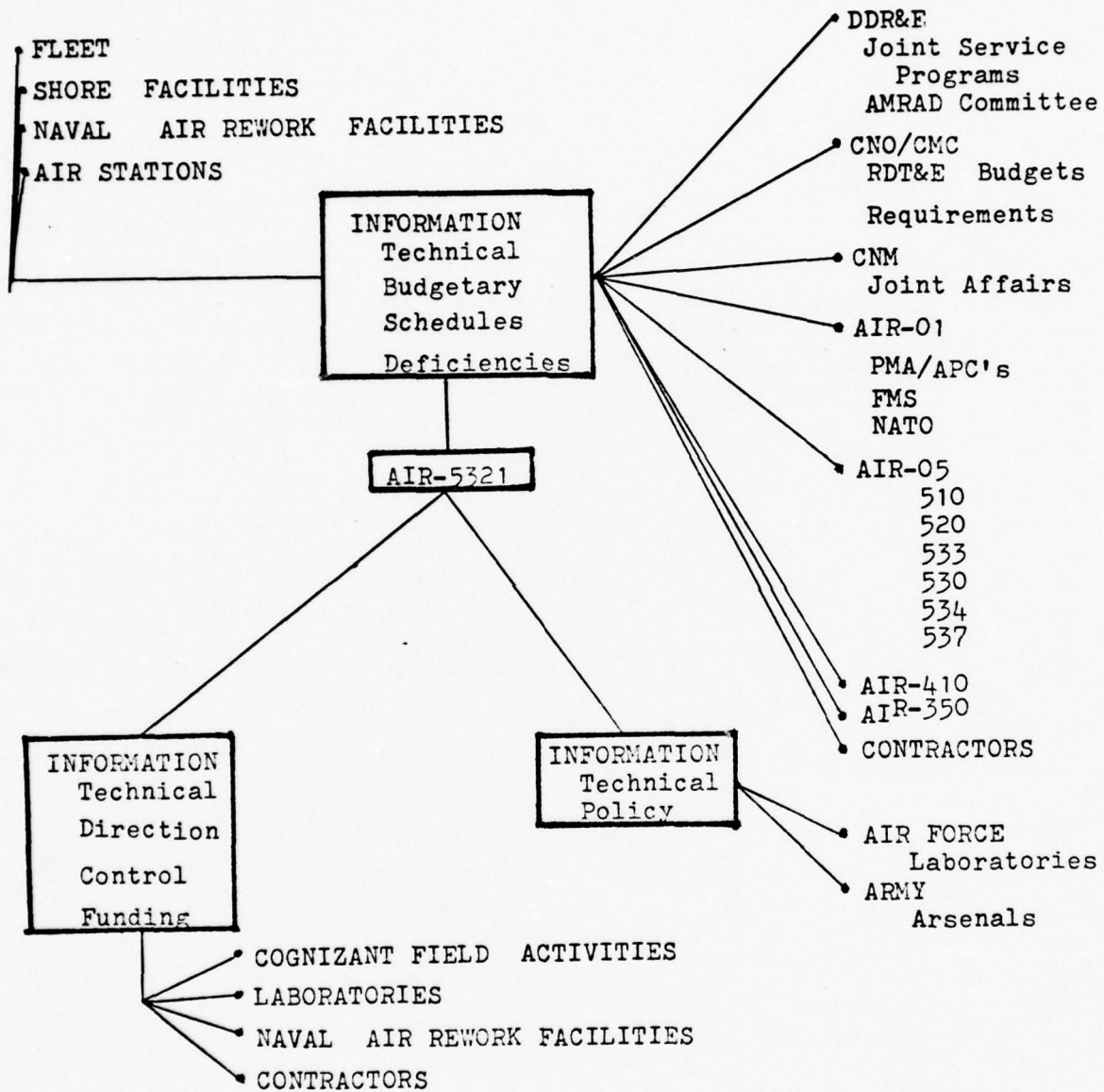


FIGURE 532-2

Management By Objectives procedures to major systems support: F-14, F-18, A-18 aircrafts for the Systems and Equipment Branch, Joint Service Programs in the Weapons Branch, and the major missile systems in the Ordnance Branch. The generalized fleet support engineering has been transitioned to various Cognizant Field Activities (CFA's) for direct management of the commodity areas - Fleet Weapons and Ordnance, CAD's, Pyrotechnics, Launchers and bomb racks, Administrative production management and procurement.

In summary, the functioning of the armament area has changed to that of technical management and program management. Present objectives are to maintain and expand the capital resources of the Division to administer its growing interfaces and at the same time improve the responsiveness by MBO.

Under the charter issued by the Commander, Naval Air Systems Command, the Division Director is established as the Program Manager. He is charged with Command wide responsibilities of management of designated armament systems/subsystems/equipments and weapons as well as appraisal and management information of program efforts. The Technical Director has the primary responsibility in the technical policy and execution as well as assisting the Director in the management of the Director. In the absence of the Director, the Technical Director has the full authority and responsibility to act for the Director (9:3).

The Director is a Naval Captain, O-6 level, with the Technical Director a civilian, GS-16.

The Systems and Equipment Branch, Weapons and Ordnance Branches are essentially engineering service groups functioning in their commodity areas. The weapons and ordnance function is in the mission expendable, one shot devices. The Systems and Equipment Branch specializes in fuzes and warheads for missiles and weapons. The Weapons Branch is cognizant of all the non-missile weapon systems. The newest branch is a direct result of the change in the character of the Division - The Program Management Branch.

The Program Management Branch combines the management, budgeting and comptroller functions into one area. This branch is responsible for the coordinative and strategic management of projects under intensive management procedures. The branch is staffed with Naval and Marine Corps Officers and civilian specialists in management and program budget analysts. The Officers are designated as the deputy program managers and are responsible for the full execution of intensive management procedures. In performing these functions the branch is responsible to ensure design and program schedule compatibility of armament systems/equipment and weapons with the aircraft system. The branch functions in the assigned areas:

- (a) Cost and schedule control of assigned programs.
- (b) Financial Management and Budget Coordination.
- (c) Baseline configuration control of assigned programs.
- (d) Program analysis and appraisal.
- (e) Harmonization of requirements/programs of multiservice applications.

(f) Technical direction of assigned programs.

Figure 532-3 shows the key interfaces for this branch. It draws its engineering, production, research and technology support from the commodity branches. The funding flows are through these branches for direct services for the acquisition and production functions. The services include engineering, facilities, contracts and production functions - contract management, production, inventory control, foreign military sales and overall weapons administration. Financial Control is exercised in the following categories of funds - Research, Development, Test and Evaluation categories 6.2, 6.3 and 6.4; Other Procurement and Operations and Maintenance; Weapons and Aircraft Procurement. Category 6.4 and other procurement monies are directly assigned to the Program Manager by the Comptroller (AIR-08) for planning, programming, and budgeting in the Five Year Defense Plan (FYDP) for weapons. The other funds are directed by PMA/APC or applicable Assistant Commander (AIR-350 for research and technology). Control can be delegated to the program manager through tasking authority to a prime contractor/laboratory/field activity after allocation and obligation of funds. This situation applies generally in the Ordnance Branch missile warheads and fuzing commodities. Financial accountability and overall centralized control resides with this Program Management Branch. Individual weapon systems programming and budgeting are directed through the engineering branches. Management engineering and technical management is exercised by the individual project engineer. The differentiation between an intensive management program and the routine

PROGRAM MANAGEMENT BRANCH

AIR-5322

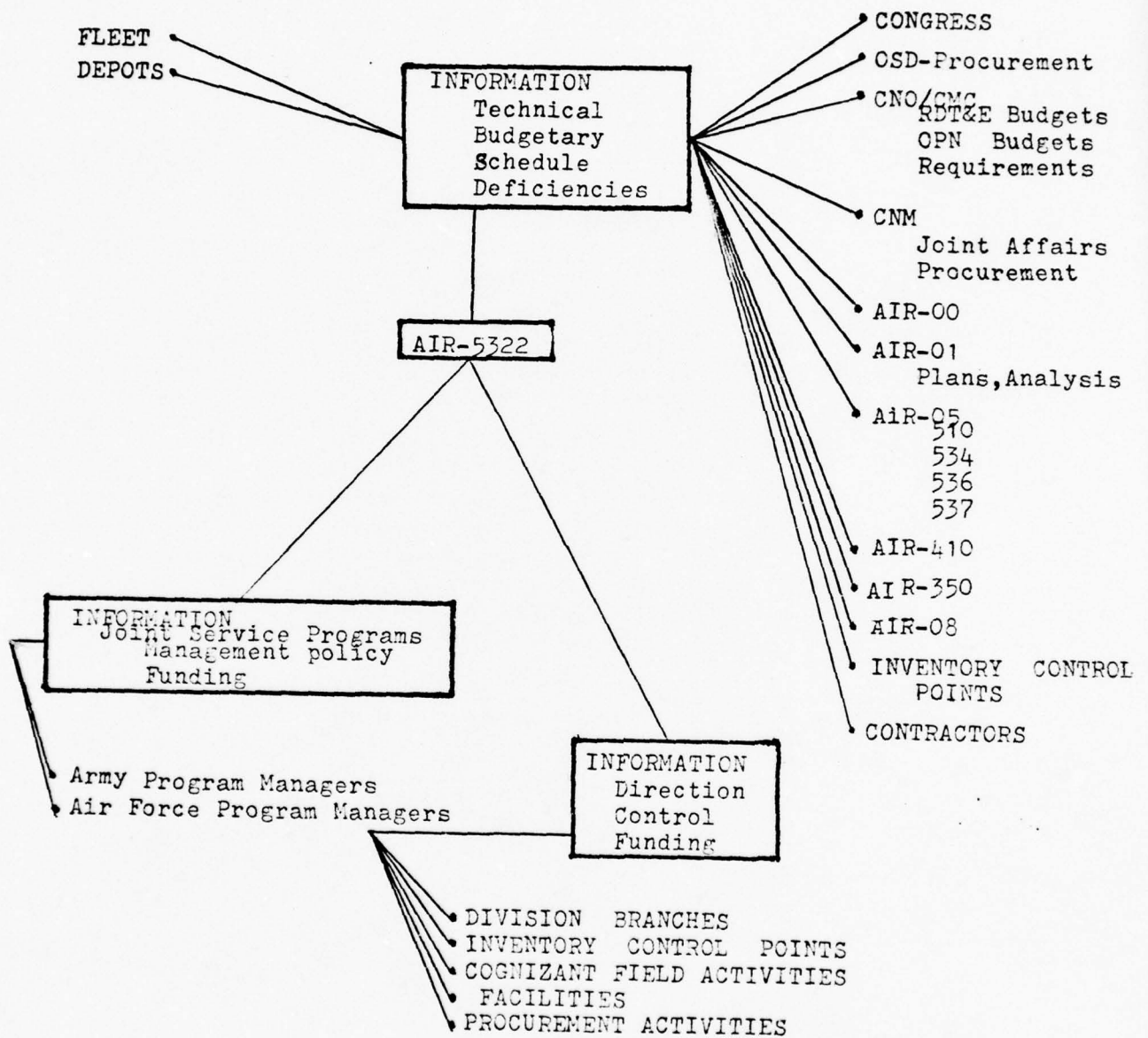


FIGURE 532-3

programs is the interrelationships between the project engineer, the branch head and the deputy program manager within the division. Under intensive management, this overall control and coordination resides with the deputy program manager. Normally, projects are directed in the technical and managerial sense by the engineering commodity branch head (Normally a senior civilian, supervisory engineer, GS-15 in grade). The interfaces, data flows, direction and controls are shown in Figures 532-2, 532-4 and 532-5. The interfaces are somewhat similar but vary due to the type of system/equipment or component involved. AIR-5322 interfaces are more with the vertical and horizontal managerial hierarchy while the branches display the typical operational functions. A further differentiation is seen due to the effects of decentralization of the fleet support functions and workload allocation. In AIR-5323, the contractor interfaces are removed one tier in the interfaces. In the other operating branches, direct interfaces can be shown as a result of directed tasking authority over contractors, the nature of the work-equipment or components in a major aircraft/missile system, and a non-decentralized management system. The last organizational differentiation is the relationship and structure of the class desk officer and the program manager. As previously detailed, the class desk officer is the focal point for internal coordination and direction relative to the major aircraft/missile system. As the lead assistant/deputy project manager, the areas of overlap and potential conflict exist in dealing with the Project Manager over directed funds, technical directions and limits of tasking authority.

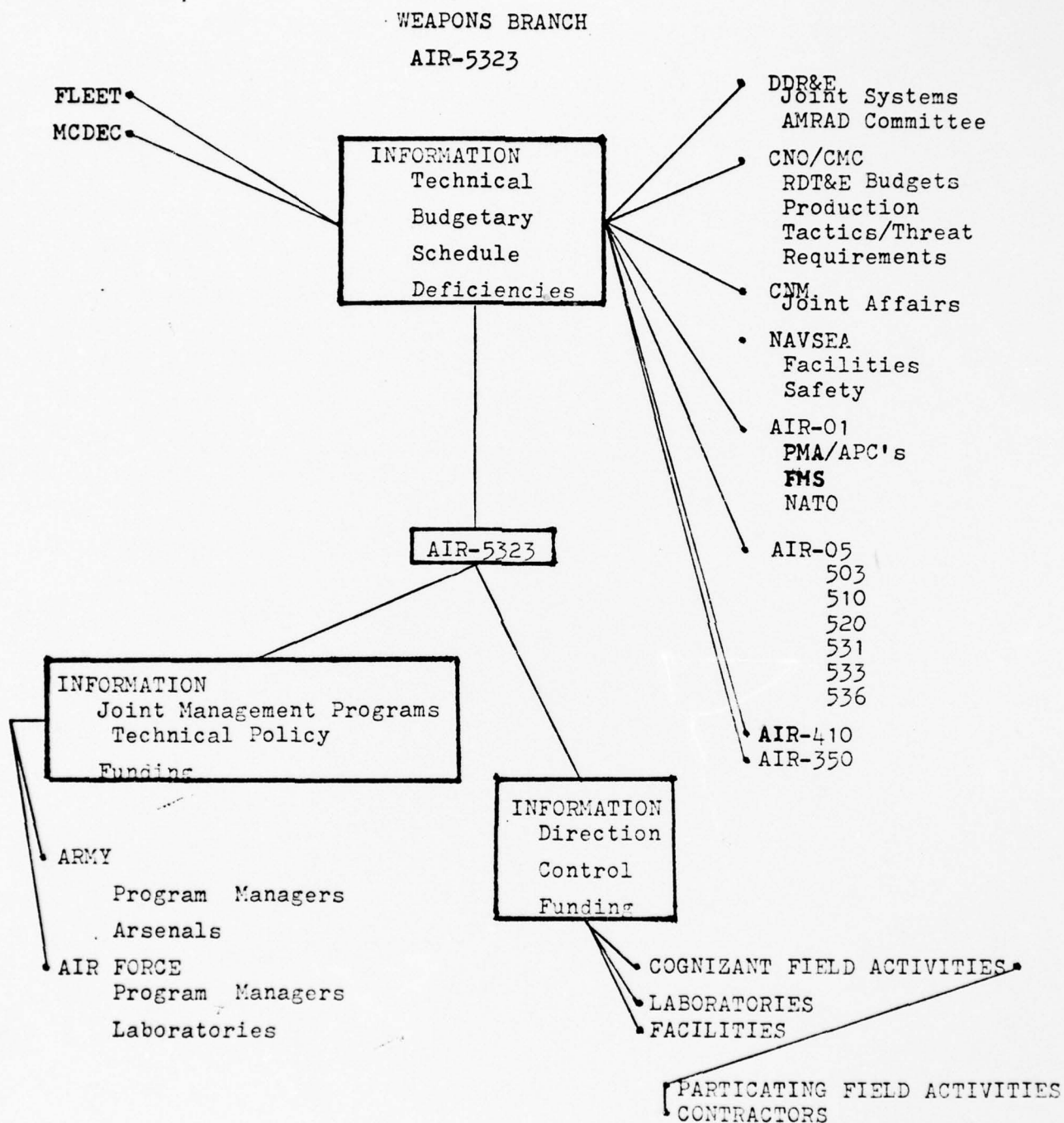


FIGURE 532-4

ORDNANCE BRANCH

AIR-5324

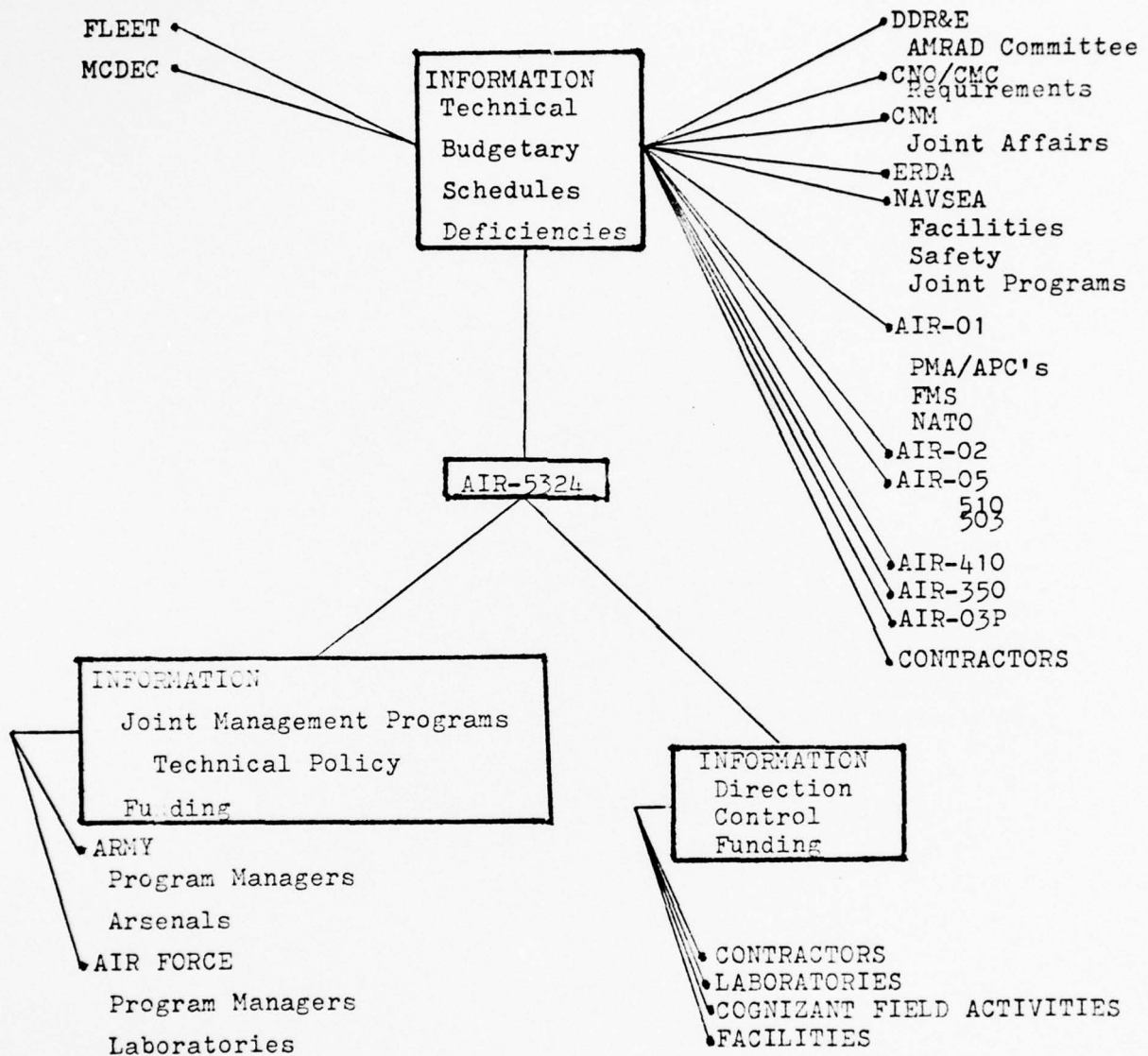


FIGURE 532-5

In this case, the potential conflict exists primarily in the Ordnance and Systems and Equipment Branches. As shown in Figures 532-2 and 532-5, the organization functions as a technical service organization in support of the PMA/APC's. Resources are assigned or tasking authority is delegated to the division. Under intensive management responsibilities service functions have been elevated to a higher organizational level to provide the visibility, responsiveness and control due to the priority of the work. Thus, the level of conflict among the program manager and the class desk has been raised under this procedure.

To date, the intensive management procedures authorized under the Program Managers Charter have only been exercised with multi-service munitions programs originating with the Weapons Branch. As this area has minimum interfacing with AIR-510, the aforementioned problem has not arisen. The selection of these programs for intensive management procedures was accomplished utilizing the criteria of workload, visibility, coordination requirements external to the Command, funding thresholds and importance assigned by the Chief of Naval Operations and Director, Defense Research and Engineering. Currently, five joint service programs are funded and underway in Engineering Development and Production with one in the harmonization stage.

Planning functions are split between the Program Management Branch and the Engineering Branches. Budgetary planning for the long-term is accomplished in the Program Management Branch. Technical

planning, both long-term and short-term is done by the Engineering Branches. The only method of tying the two together is through the Naval Aviation Plan for Research and Technology or the FYDP. The thrust of MBO has yet to take an integrated approach in this area

(10).

AVIONICS DIVISION (AIR-533)

The Avionics Division has the responsibilities for research, development, test and evaluation cycle for every aspect of avionics and electrical power distribution for all aircrafts, air-launched missiles and space electronics. The division exercises authority over the production engineering, production and in-service engineering of related aircraft systems and components. These systems and components can be categorized as follows:

- (a) Communications equipment and IFF.
- (b) Instrumentation, navigation, and displays.
- (c) Electronic warfare, counter and counter-counter measures.
- (d) Embedded fire control, weapon guidance and control.
- (e) Computer systems.
- (f) Flight control systems.
- (g) Built-in-test equipment and test instrumentation.
- (h) Airborne Anti-submarine warfare and mine counter measures.

The division is organized as shown in Figure 533-1. The organization shown is essentially broken into engineering commodity areas structured along the categorized areas. Its evolution is similar to that of the Armament Division. As such it is operating in the same environment as is the other groups, such as the Propulsion Division AIR-536, within AIR-05. Those differences are variations which result from the basic nature of the work-systems and components embedded into the aircraft/missile systems. As a result, the divisions

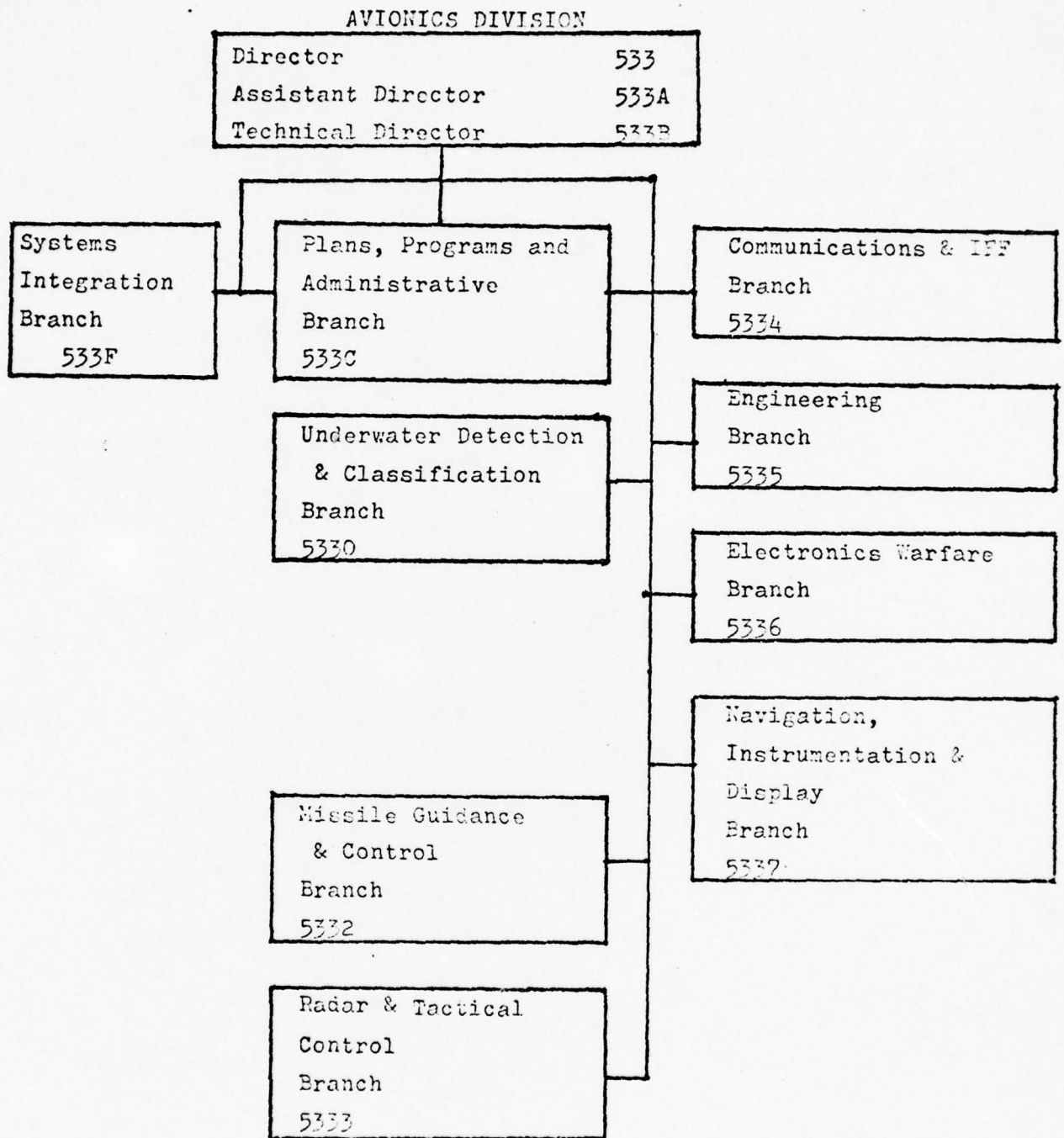


FIGURE 533-1

operating procedures are geared to the PMA/APC's projects much more closely than the Armament Division. Similarly, there exists a commonality of systems for multiple platform applications, especially in the electronic warfare areas and power/instrumentation commodities.

In tailoring the application of program management in this field, the limitations of the scope of effectiveness, flexibility and application is very precise. In the chartering of this Program Manager, the following functions are specifically identified:

- (a) The authority and responsibilities and functions defined as attributes to the NAVAIR Program Manager.
- (b) The degree of implementing intensive management procedures will vary depending upon the avionics system and its position in the acquisition cycle. Detailed charters will be formalized and promulgated on a case by case basis. These programs are less-than-major avionics systems/subsystems/components/equipment in which the Comptroller, AIR-08, has directed funds to the Program Manager.
- (c) Function as the executive Acquisition Manager in the area of Government Furnished Equipment supplied to two or more weapon systems. If only one platform is involved, the Division Director will act as the exclusive Acquisition Manager. The term Acquisition Manager refers to the management functions, responsibilities and authority applicable during the acquisition phase of a weapon life cycle. Its scope and constraints are formally defined by NAVAIR as the individual/organizational element charged with the responsibility for design, development and acquisition of the system or equipment and its integrated logistics support.
- (d) Act as the central executive responsible for approving/disapproving engineering in-service and support tasks under on going Services and Support Programs (11:3).

Financial management and control is exercised in the same appropriations as discussed in the Armament Division. The allocation and control of funding is also similar to AIR-532. For this division, the

directed funds are identifiable as a line item in the PMA/APC budget as a major component rather than categorized in a general manner under the generic commodity avionics.

Reporting procedures, management information system responsibilities and appraisal are similar except to the degree of specificity of procedures to be utilized between the PMA/APC's and the Program Manager.

The major variance in the implementing structure is two-fold. The first is the assignment of integrated logistic support responsibilities as an Acquisition/Program Manager. This exists within the Armament Division tasking and authority. However, the application within the division are directed toward expendable devices which require a minimum of logistic support. Avionics equipment is considerably different in this area so this aspect is a major part of the intensive management procedure utilized by the Avionics Division.

Intensive Management procedures will be implemented under a team concept with its support drawn from intra/inter divisional groups within NAVAIR. This differs from the Armament Divisions approach of one deputy program manager and project engineer drawing support from the laboratories and cognizant field activities as a team. The formalized team within NAVAIR headquarters for a designated avionics program manager will have the same two individuals - a deputy program manager and a project engineer - but augmented with elements from logistics, contracts, acquisition and test areas.

In addition, the overall Program Management team will draw support from laboratories and cognizant field activities and procurement assistants. A further differentiation which results from the commodity involved. Within the Armament Division the integrated logistics support aspects pertaining to training and specialties of fleet personnel are minimal. Avionics requires a high level of skill development of personnel and facilities for their effective use in the fleet. Thus, the additional interfaces - Bureau of Personnel and the Training Command are added to the expanding list of interfaces for coordination, planning and budgeting for the Avionics Program Manager. The accomplishment of this planning lies with the integrated team approach. It is coordinated and presented to the PMA/APC's for incorporation as a line item which the Project Manager then directs and controls for his weapon system.

The relationships with the Class Desk Officers is explicitly detailed and scoped within the charter to avoid the potential conflicts discussed in the Armament Division section. The constraints developed by the class desk and technical requirements are considered in the development/modernization of assigned systems/subsystems/equipments and components. The methods of resolving such conflicts are not detailed.

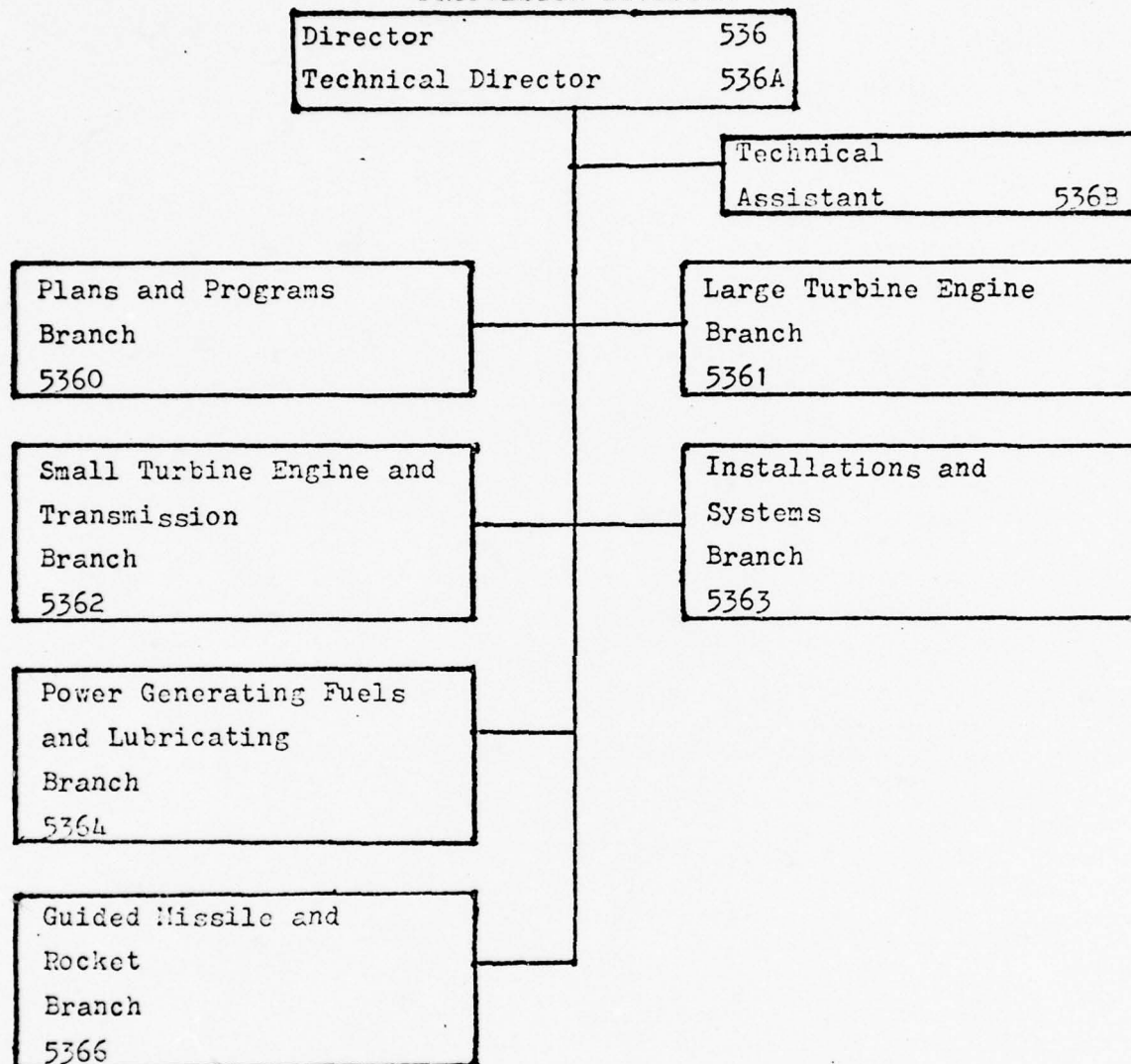
PROPULSION DIVISION (AIR-536)

The Propulsion Division is responsible for conceiving, planning, implementing and managing programs for the engineering development, test and evaluation of propulsion systems, propellers and electric power systems. These systems and components are applied to all aircraft systems, rockets, missiles and drones. The division is responsible for all aspects of performance, selection, qualification, production, procurement and product support as related to propulsion systems and their components. The technology programs during conceptual phase are assigned by the Research and Technology Administrator. Figure 536-1 defines the organizational structure for this division. These efforts can be categorized as follows:

- (a) Primary propulsion systems and related products both large and small.
- (b) Secondary power systems and related components.
- (c) Guided missile and rocket motors and propellants.
- (d) Installations and applications.
- (e) Fuels and lubricants.

As shown, the organization is essentially broken into the engineering commodity/product areas. Its evolution and constraints are similar to the other divisions in AIR-05. The systems and components are the major embedded system in the aircraft or guided missile. These major elements of the weapon system result in a highly visible

PROPULSION DIVISION



organizational structure geared as a service to the individual weapon platform. An individual is assigned as that primary support to the PMA/APC for the majority of the assigned element workload. Thus, manpower and staffing drive the responsiveness of the organization much more acutely than in any other division.

In tailoring the application of program management, this division has chosen to implement the concept uniformly upon the entire division. The staffing and structure will vary with respect to the individual propulsion system. Critical high priority systems will have a full time designated Deputy Program Manager within NAVAIR. Less critical equipment will be managed by subordinates as a dual function - i.e. project engineer will perform program management type functions. In application, the scope of intensive management involves financial management and its attendant planning, programming and budgeting, execution, appraisal and information systems. Funding and control of functions will be in accordance with the previously described methods in the Armament and Avionics Divisions (12:2).

The implementation is similar to those of the other two divisions. The logistics and fleet support aspects are involved to a larger degree than the Avionics team concept of implementation. This is to a large degree due to both complexity and priority of this commodity to the weapon system. The propulsion system Program Manager is by definition the ultimate responsibility for availability, adequacy and readiness of these systems in the fleet and shore-

based activities. To control this interface, an overview and coordination of objectives in the logistic support area will be performed through the program management function even though the specific funds involved are not under direct control.

The relationships with the Class Desk Officers is similar to those defined in previous intensive management procedures. However, the Propulsion Manager's Charter specifically states the methods of resolving conflicts in the area of technical integration and overall policies and objectives. The vehicle will be to the Assistant Commander for Material Acquisition, then the Project Manager and if required, Commander Naval Air Systems Command for significant differences.

The interface relationships and scope of authority and responsibility between the PMA/APC's and the Program Manager is the same as defined in the Avionics Division. The joint service interface is similar to that defined in the Armament Division as well as the Information Exchange Programs and Data Exchange Agreements with foreign governments (13).

ANALYSIS AND CONCLUSIONS

Program Management as defined within NAVAIR has some specific attributes which can be addressed:

- (a) Specific definable tasks of finite duration have been selected for intensive management procedures.
- (b) Deliberate conflict is structured between the various PMA/APC's, the Class Desks and the Program Managers.
- (c) The Program Manager within certain limitation decides the when and what of the program as well as the how to support the task.
- (d) Line authority is well defined. Tasking across functional lines is defined but not exercised.
- (e) Staffing a full time organization for an intensive management team is extremely limited. Part time duties appear to be the method of implementation.
- (f) Information flows, appraisal and direction are heavily emphasized. Fiscal control and accountability are assigned with Program Management.

Program Management is evolving as a curious hybrid of an intensive management organization. The scope of work is clearly definable to a specific result and is unique. The charters, however, range from specificity in authority and responsibility of scope of work to general areas of actions. The implementation and program selection is based on complexity, acquisition of technology, time and risk as the primary vehicles for program management. This management system is a blend of functional and product organizations. A functional organization in this case is engineering, plans and programs, budget and production. A product organization is character

by an organization necessary to entirely support the product. The functional organization maximizes available manpower while the product organization maximizes control at the expense of increased personnel. Program Management has blended portions of both into a single organization. To accomplish this, the organization has decentralized its routine fleet support missions to Cognizant Field Activities. The differing Divisions are at various stages of maturity with the Armament Division and Avionics Division slightly more mature in application than the Propulsion Division. This newness has been reflected in the project selected for intensive management procedures. The projects have been well defined within the context of both the objectives and resources as well as the authority and responsibility of the charters. As the managerial system matures, the selected projects will expand to the limits of the charters scope. The basic constraints which will inhibit this growth will be the environment in which the divisions operate. The capital resources - both manpower and funding - will continue to be constrained for the foreseeable future. Organizational conflicts and the fact that the divisions remain functional organization will also tend to limit the application of intensive management procedures(14).

There is a distinction between technical management and management of a technical activity (Intensive management procedures). Technical management is the management of the technical aspects of a program within the constraints of the program. It will involve technical approaches, financial management, and personnel necessary

to accomplish the project objectives. In short, it is limited to the specific technical objectives and the secondary support necessary to achieve the stated goal.

Management of a technical activity increases the scope of management responsibilities and actions. It involves the overall selections of what technical objectives to pursue within the organization and how to allocate available resources to maximize the return of success. The selection of personnel and the criteria to evaluate them is but one of the issues under this management systems. Program Management is one such system within this management field. The means of directing and controlling these intensive management procedures are specified in the chargers.

The power exercised by a program manager is the authority derived from the legal, personal and political power delegated in NAVAIR. Within this framework, line, staff, and functional authority, exists. Line authority is that in which authority is derived from legal statute. Staff authority is one in which the relationships is a control factor placed upon an individual in line authority. The program manager derives his authority from the legal authority his charter and acts from both a line and staff position. The use of staff authority (Tasking across functional lines to accomplish stated goals) depends upon the individuals technical competence, and hierarchetical position. The latter element has a problem associated in that the commodity has been elevated in status while the position remains one of a functional division director.

Authority is implied in the sense of invoked power through the

chain of command via the Commander. Functional authority is one in which the individual acts as the authority within the scope of organizational functions. Program Management displays both line and staff authority, legal and functional authority. It combines the best of both the functional and project management managerial systems of authority and accountability. The political authority deals with the organizational goals and their relative priority. Here it is clearly delineated in NAVAIR in the charter with the precedence order of Project Manager, Project Coordinator, and Program Manager. The Program Manager is the lower position yet it remains an intensive management system implemented in the Command.

The implementing concept of intensive management in NAVAIR is in the aggregate represented by the Equipment and Systems Branch, AIR-5321. All elements are shown with this selection. A confederator - unity of direction - is provided to the selected project. Individuals are not assigned on a full time basis nor a subject to day to day supervision. Under the implementing process a full time deputy program manager is assigned as a staff position usually in the Plans and Programs Branch or in the Armament Division Program Management Branch. The common characteristics are a separate branch which originates budgetary and information control and draws on the team within the divisions branches. It consolidates the functions of budgetary control, communications and direction, planning and appraisal into a single focal point. Budgetary control in this case can be broken into two definable areas - the planning, programming and budgeting carried on to support the operations of

the divisions and cost estimating for planning purposes. The divisions all have individuals trained and designated to handle the former but not the latter capability(15:352).

These methodologies (Expert judgement, analogy, Engineering and Parametric cost estimating) must be developed for the less than major systems under intensive management procedures. Cost estimating by expert judgement is the least quantitative yet is the most frequently by the divisions. Expert judgement may be defined as the comprehensive knowledge of a system by an individual or group that is required to reach a conclusion that is not directly supported by data. In short, expert judgement is an educated guess. Its deficiencies are the key requirements for knowledge and perspective. The experts must be familiar with both the technology and applications environments.

The analogy technique of cost estimating is another type of judgemental approach. In this case, the cost estimate for the proposed system is derived by analyzing information on another similar, but not identical, systems. The inherent drawbacks are in the selection of the appropriate system for analogy and the manipulation of the data base to normalize the available information. The major problem with this implementation is the development of the data base. In the Armament Division this data base does not exist.

An Engineering Cost estimate involves the generation of detailed estimates of the material and labor costs for each component of a system and finally for the system as a whole. The accuracy

of the estimate will depend on the level of detail which is achievable. Usually, this type of estimate is only capable of being furnished via a contractor or a field activity involved in procurements of similar systems and equipment. The inaccuracies of this approach are two fold. First, is underestimating at a detailed level which is compounded when the overall system estimate is generated. Secondly, the cost of integrating the components and subsystems into the final package are often underestimated (The magnitude of the systems engineering effort is the major variable).

Parametric cost estimating attempts to identify and quantify a functional relationship between system/equipment cost and one or more of the systems characteristics or parameters. This transfer function is called the cost estimating relationship (CER). The technique is the most quantitative of the approaches and relies on the extensive application of statistical analysis. This use of analysis not only estimates the most probable cost but also a range of possible costs for which a degree of certainty can be specified. The use of parametric estimates involve three operations - First, the historical data must be analyzed; Secondly, a regression analysis must be done on the selected data to obtain the equation and parameters for the CER; Finally, the CER must be analyzed statistically and empirically to verify its validity (16,17).

The cost estimating requirements exists in the Material Acquisition Group for the evaluation of aircraft and missile systems cost in contractor proposals. However, in less than major

programs and small programs the capability does not exist within the individual divisions except from the engineering estimates of in-service equipment and analogy techniques. With the application of intensive management, the divisions must now develop this capability either within their own team or within AIR-05. As most of the required data and expertise will be within the respective divisions, the development of parametric cost estimating appears as the most reasonable approach considering the data base and capital resources.

The development of communications in the formal and informal structure is the primary responsibility of the Program Manager. There have been numerous studies of the form and nature of communications by scientists and engineers. They place primary reliance upon local informal sources. The more familiar an individual is with the organization and the more unfamiliar with the problem, the more such local sources are utilized. There is a general reluctance to go to these sources since the individual has an aversion for asking for help. Thus, you can build a situation of isolation of your technical resource if left alone.

The "high performers" in an organization generally tend to work longer, communicate more and communicate with more people. This is largely a result of more training and background in a given field tends to be more open in communications as confidence is built. The more professionally oriented will pursue further education both formal and informally. They are more apt to work in developing new concepts while the less professionally oriented

are more concerned with operational problems. This type of division is necessary for determining the future development of managers as the latter will be self motivated to move into the management of technical activities with a people orientation.

Users of information are generally not satisfied with their ability to obtain information although most feel they are generally successful in getting needed information in the time available. The higher an individuals salary and importance to the organization, the more he tends to encounter problems in acquisition and the use of information. Transfer of information is best accomplished by movement of key personnel (18).

Program Management and the implementation of such a concept within NAVAIR has an excellent capability. This procedure will be supportable over the foreseeable time frame when applied to programs of unique scope. It should not and can not be applied to every effort within an operating division. The success of such procedures depends upon these key elements:

- (a) The development of cost estimating capability for the Program Manager, either in house or under contract support.
- (b) The team concept whether applied to the Armament, Avionics or Propulsion Divisions interpretation has to be formalized and communicated throughout the Command. The individuals and their responsibilities must be identified so that the lines of communications are utilized.
- (c) The team must have identity for its members. The relationship of the individuals and the division interaction must be defined by the Program Manager or Deputy Program Manager for it to operate with enthusiasm and effectiveness to reach the program goals.

- (d) The training programs must recognize the two categories of management activities, technical management and management of technical activities, for the development of its team members.
- (e) The assumptions for the constraints and work load will remain valid for the future. Capital resources will remain fixed and successful operation of the decentralized functions and their budgetary support will continue at the present levels.

With these elements, Program Management in a functional engineering organization is effective and responsive to the needs of NAVAIR.

ACRONYMS

AMRAD - Air Munitions Requirements and Development
CMC - Commandant of the Marine Corps
CNM - Chief of Naval Material
CNO - Chief of Naval Operations
DDR&E - Director, Defense Research and Engineering
ERDA - Energy Research and Development Administration
FMS - Foreign Military Sales
FYDP - Five Year Defense Plan
IFF - Identification, Friend or Foe
NATO - North Atlantic Treaty Organization
NAVSEA- Naval Sea Systems Command
OSD - Office of the Secretary of Defense

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